REMARKS

Applicant has carefully studied the outstanding Office Action. The present response is intended to be fully responsive to all points of rejection raised by the Examiner and is believed to place the application in condition for allowance. Favorable reconsideration and allowance of the application is respectfully requested.

Claims 1-15 are pending in this case. Claims 1-3, 6-8, 10, 14-15 have been rejected under 35 U.S.C. § 102(e). Claims 11-12 have been rejected under 35 U.S.C. § 103(a). Claims 4-15 are objected to. Independent claims 1, 6 and 10 and dependent claims 4, 9, 13 have been amended. New claims 16-17 have been added.

Claim Objections

The Examiner has objected to claims 6-15 because of several informalities. Claim 6 has been amended to replace "V" with --N-- and claim 10 has been amended to provide a definition for "N" in accordance with corrections required by the Examiner. The Examiner is respectfully requested to withdraw the claim objections.

35 U.S.C. § 102(e) Rejections - Timm et al.

The Examiner has rejected claims 1-3, 6-8 under 35 U.S.C. § 102(e) as being anticipated by Timm et al. ('268). Because Timm et al. does not teach the present invention, Applicants traverse the rejection and request reconsideration.

Timm et al. teaches a communication system with receiving and transmitting paths that utilize a multimode digital modem having a direct equalizer system. The equalizer system uses an adaptive filter in the transmission path to compensate for frequency distortion of the communication channel. The transmitter filter coefficients are adapted by a filter coefficient calculator under control of a data detector, which detects incoming data in the receiving path.

While continuing to traverse the Examiner's rejections, Applicant, in order to expedite the prosecution, has chosen to clarify and emphasize the crucial distinctions between the present invention and the devices of the patents cited by the Examiner. Specifically, claim 1 has been amended to include a point to point facility transport system for the symmetrical bidirectional transport of 100BaseTX Ethernet frame data over N copper wire pairs connecting a central office facility to a customer premise comprising N downstream transmission paths for transporting a single 100BaseTX Ethernet signal from the central office facility to the customer premise, each downstream transmission path operative to transport a 25 Mbps data stream, N upstream

transmission paths for transporting a single 100BaseTX Ethernet signal from the customer premise to the central office facility, each upstream transmission path operative to transport a 25 Mbps data stream, first modem means located at the central office facility and coupled to one end of the N downstream transmission paths and one end of the N upstream transmission paths, second modem means located at the customer premises and coupled to the other end of the N downstream transmission paths and the other end of the N upstream transmission paths, wherein the first modem means and the second modem means are operative to place onto and receive from the N copper wire pairs, data frames encapsulating the 100BaseTX Ethernet frame data and wherein N is a positive integer in the range of one to four.

It is submitted that the MDSL system of Timm et al. transports data asymmetrically at throughput rates of 384 kbps in the upstream direction and 2.048 Mbps in the downstream direction (col. 17, lines 42-44). In contrast, the data rate of the 100BaseS transmission system of the present invention is capable of throughput rates of 100 Mbps **symmetrically** in both directions.

Further, the system of Timm et al. teaches transmitting an input data stream over a single copper facility. In contrast, the 100BaseS system of the present invention is operative to split the received 100 Mbps Ethernet signal into up to four separate signals of 25 Mbps each, wherein each 25 Mbps signal is adapted to be transported over an individual copper pair. Thus, four copper pairs can be used to transport an input 100 Mbps Ethernet signal.

Applicants submit that Timm et al. fails to teach a system for the symmetrical bidirectional transport of 100BaseTX Ethernet frame wherein the Ethernet data is transported over one to four copper pairs, each copper pair adapted to transport 25 Mbps data encapsulated in a DSL signal.

It is believed that amended independent claims 1 and 6 overcome the Examiner's § 102(e) rejection based on the Timm et al. reference. The Examiner is respectfully requested to withdraw the rejection based on § 102(e).

35 U.S.C. § 102(e) Rejections - Booth

The Examiner has rejected claims 10, 14-15 under 35 U.S.C. § 102(e) as being anticipated by Booth ('073). Because Booth does not teach the present invention, Applicants traverse the rejection and request reconsideration.

Booth teaches a system and method for auto-polling a status register within a PHY interface to a LAN. The system includes a host CPU for detecting and servicing interrupts generated by the PHY device on the LAN coupled between a first transmission and a management interface to the system.

While continuing to traverse the Examiner's rejections, Applicant, in order to expedite the prosecution, has chosen to clarify and emphasize the crucial distinctions between the present invention and the devices of the patents cited by the Examiner. Specifically, claim 10 has been amended to include a point to point facility transport system for the symmetrical bidirectional transport of 100BaseTX Ethernet frame data over N copper wire pairs connecting a central office facility to a customer premise comprising N downstream transmission paths for transporting a single 100BaseTX Ethernet signal from the central office facility to the customer premise, each downstream transmission path operative to transport a 25 Mbps data stream, N upstream transmission paths for transporting a single 100BaseTX Ethernet signal from the customer premise to the central office facility, each upstream transmission path operative to transport a 25 Mbps data stream, switch means located at the central office facility and coupled to one end of the N downstream transmission paths and one end of the N upstream transmission paths, a network element located at the customer premises and coupled to the other end of the N downstream transmission paths and the other end of the N upstream transmission paths, wherein the switch means and the network element are operative to place onto and receive from the N copper wire pairs data frames encapsulating 100BaseTX Ethernet frame data and wherein N is a positive integer in the range of one to four.

It is submitted that Booth, in col. 4, lines 7-27, discusses the various 100 Mbps Ethernet standards including 100BaseTX and 100BaseT4. The former standard uses a 2 pairs to transmit differential transmit and receive signals. The latter standard uses 2 pairs for transmit and an additional 2 pairs for receive, for a total of 4 pairs. In both standards, special UTP cable is required for transmission. In the case of 100BaseT, Category 5 UTP cable is required and in the case of 100BaseT4, less expensive Category 3 UTP cable may be used.

In contrast, the 100BaseS facility transport system of the present invention utilizes the existing copper infrastructure already in place for POTS service between customer premises and the central office. The invention does not require special UTP cabling for operation.

Further, the transmission of standard Ethernet over UTP cable is unidirectional in that separate pairs are required for transmission and reception. In contrast, the 100BaseS system transports data bidirectionally, wherein each 25 Mbps increment is transported bidirectionally over a single copper wire pair.

Applicants submit that Booth fails to teach a system for the symmetrical bidirectional transport of 100BaseTX Ethernet frame wherein the Ethernet data is transported over one to four copper pairs, each copper pair adapted to transport 25 Mbps data encapsulated in a DSL signal.

35 U.S.C. § 103(a) Rejections - Booth/Timm et al.

The Examiner has rejected claims 11-12 under 35 U.S.C. § 103(a) as being unpatentable over Booth in view of Timm et al. Because neither Booth nor Timm et al. shows or suggests the invention as claimed, Applicants traverse the rejection and request reconsideration.

Because Booth and Timm et al. do not anticipate or suggest Claim 10 as discussed above, then claims 11-12 are allowable as well. The Applicant respectfully traverses the objections of claims 11-12 and submits that the presently claimed invention is patently distinct over Booth in view of Timm et al.

New Claims

New claims 16-17 have been added. Support for the new claims may be found throughout the specification and drawings as filed in this application. In particular, reference may be made to page 5, line 1 through page 28, line 15 and the Figures references therein. No new matter has been added.

Correction of Typographical Errors

Amendments haven been made to correct grammatical and usage errors in the specification. No new matter has been added to the application by these amendments.

Conclusion

In view of the above amendments and remarks, it is respectfully submitted that independent claims 1, 6, 10, 16-17 and hence dependent claims 2-5, 7-9, 11-15 are now in condition for allowance. Prompt notice of allowance is respectfully solicited.

In light of the Amendments and the arguments set forth above, Applicants earnestly believe that they are entitled to a letters patent, and respectively solicit the Examiner to expedite prosecution of this patent applications to issuance. Should the Examiner have any questions, the Examiner is encouraged to telephone the undersigned at (312) 913-0001.

Respectfully submitted,

Sept. 23, 2002

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U.S. Patent Application entitled:
HIGH DATA RATE ETHERNET TRANSPORT FACILITY OVER DIGITAL SUBSCRIBER LINES
Application Serial No.: 09/322,062 Filed: May 27, 1999
Inventors: Avinoam Rubinstain et al.

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

Paragraph beginning on page 1, line 15

There is a growing need among both individuals and enterprises for access to a commonly available, cost effective network that provides speedy, reliable services. [There is high demand] Demand is high for [a] high-speed data [network, one with] networks with enough bandwidth to enable complex two-way communications. Such an application is possible today if, for example, access is available to a university or a corporation with sufficient finances to build this type of network. But for the average home computer user or small business, access to high speed data networks is expensive or simply impossible. Telephone companies are therefore eager to deliver broadband services to meet this current explosion in demand.

Paragraph beginning on page 1, line 23

One of the problems is that millions of personal computers have found their place in the home market. Today, PCs can be found in approximately 43% of all United States households and a full 50% of teenagers in the United States [teenagers] own computers. Virtually every PC sold today is equipped with a modem, enabling communication with the outside world via commercial data networks and the Internet. [Currently, people] Typically, computer owners use their PCs to send and receive e-mail, to access online services, to participate in electronic commerce and to browse the Internet. The popularity of the Internet is such that there are an estimated 50 million users around the globe. These figures indicate that in the past few years the personal computer has fueled a dramatic increase in data communications and the corresponding demands on the data networks that carry the traffic.

Paragraph beginning on page 2, line 1

The Internet serves as a good example of the increased demands that have been placed on data networks. At first, Internet access consisted of text only data transfers. Recently, with the popularity of the World Wide Web (WWW) and the construction of numerous sites with high quality content, coupled with the development of Internet browsers such as Mosaic, Netscape

Navigator and Microsoft Internet Explorer, the use of graphics, audio, video and text has surged on the Internet. While graphics, audio and video make for a much more interesting way to view information as opposed to plain text, bandwidth consumption is significantly [more] higher. A simple background picture with accompanying text requires approximately 10 times the bandwidth needed by text alone. Real-time audio and streaming video typically need even more bandwidth. Because of the increased requirement for bandwidth, activities such as browsing home pages or downloading graphics, audio and video files can take a frustratingly long period of time. Considering that the multimedia rich World Wide Web accounts for more than one quarter of all Internet traffic, it is easy to see why the demand for bandwidth has outpaced the supply. In addition, the creative community is pushing the envelope by offering audio and full motion video on numerous sites to differentiate themselves from the millions of other sites competing for maximum user hits.

Paragraph beginning on page 3, line 10

Today's most popular data access method is POTS. [But as] As discussed previously, however, POTS is limited when it comes to large data transfers. An alternative to POTS currently available is Integrated Services Digital Network (ISDN). In the past few years, ISDN has gained momentum as a high-speed option to POTS. ISDN expands data throughput to 64 or 128 Kbps, both from the network to the home and from the home back to the network, and can [be] technically be made available throughout much of the United States and in many other parts of the globe. Similar to POTS, ISDN is a dedicated service, meaning that the user has sole access to the line preventing other ISDN users from sharing the same bandwidth. ISDN is considered an affordable alternative, and in general, ISDN is a much better solution for applications such as Web browsing and basic telecommuting. However, like POTS, [it] ISDN severely limits applications such as telecommuting with CAD files and full-motion video viewing. The latter requires roughly 39 times the throughput than that provided by ISDN. Multichannel multipoint distribution service (MMDS), a terrestrial microwave wireless delivery system, and direct broadcast satellite (DBS), such as DirecTv and US Satellite Broadcasting (USSB), are wireless networks. They both deliver high bandwidth data [steams] streams to the home, referred to as downstream data, but neither has a return channel through which data is sent back over the network, referred to as upstream data. Although it is a relatively affordable system to deploy for broadcast applications, because it requires no cable wires to be laid, it falls short in interactive access. In order to use a wireless system for something as basic as e-mail, an alternate technology such as a telephone line must be used for the upstream communications.

Paragraph beginning on page 4, line 5

Hybrid fiber coax (HFC), a network solution known in the art and currently offered by telephone and cable companies, is yet another option for delivering high bandwidth to consumers [known in the art]. However, HFC has limitations[.] one of which is that HFC networks provide a downstream capacity of approximately 30 Mbps, which can be shared by up to 500 users. Upstream bandwidth is approximately 5 Mbps and also is shared. A disadvantage with HFC is that shared bandwidth and limited upstream capacity become serious bottlenecks when hundreds of users are simultaneously sending and receiving data on the network, with service increasingly impaired as each user tries to access the network.

Paragraph beginning on page 12, line 13

In [one installation] an example application of the invention, 100BaseS transmission [would be] is used on shorter exchange lines when the switch or ONU is located in a serving exchange building. The switch or ONU may be [sited] placed in different locations forming different architectures for a hybrid optical network. Some of these architectures include: fiber to the cabinet (FTTCab), fiber to the curb (FTTC), fiber to the node (FTTN), fiber to the building (FTTB) and fiber to the exchange (FTTEx).

Paragraph beginning on page 12, line 19

The 100BaseS transport facility of the present invention supports both LAN and POTS services sharing the same copper distribution cable. The POTS and the LAN services are separated close to the point where the combined signals enter the customer premises. This is achieved by a POTS splitter filter, i.e., splitter/combiner filter, which may or may not be part of the network termination (NT). The 100BaseS system is a point to point transmission system even though the core modem is a blind modem that is able to support point to multipoint communications. The network termination interface at the customer premises can be the widely used 100BaseT RJ-45 interface. The customer can [hook up] connect any common 100BaseT equipment, such as an Ethernet switch or hub, or any product [that has] having an Ethernet network interface card (NIC). The network interface unit will respond to test and management messages originated by any SNMP network management system.

Paragraph beginning on page 12, line 30

The system supports two latency modes that can be modified by software or through [the] network management: (1) with an interleaver resulting in a latency of less than 20 msec[;] or (2) without an interleaver resulting in a latency of less than 200 microseconds.

Paragraph beginning on page 13, line 18

It is [important to note] also noted that the network comprising computer workstations and the Ethernet hub, shown connected to the access switch in the example in Figure 1, is presented for illustrative purposes only. One skilled in the art can [assemble] construct numerous other configurations without departing from the spirit and scope of the present invention. The access switch of the present invention can be coupled to any device able to communicate using 100BaseT.

Paragraph beginning on page 13, line 23

Each of the access switches comprises 100BaseS modems that communicate with each other using the 100BaseS modulation and protocol scheme of the present invention disclosed herein. The modems, including the transmitter and receiver portions, incorporated in the access switches are described in more detail hereinbelow.

Paragraph beginning on page 14, line 9

POTS splitters 22 [communicate] are connected to POTS splitters 24 which are typically physically located in remote locations in different areas of the customer premises. For example, the customer premises may be a large university campus with communication links spanning out to each building within the campus. The communication links [would] carry a combination of 100BaseS and POTS traffic. With reference to Figure 2, the links between the POTS splitters 22 and 24 carry a combined 100BaseS transmission signal in addition to the POTS voice signal. The PBX and the network equipment would typically be installed in the telecommunications equipment room that also serves as the service entrance or network termination point (NTP) to the telco lines from the central office.

Paragraph beginning on page 14, line 21

A block diagram illustrating an optical network unit connected to multiple customer premises via the 100BaseS transport facility is shown in Figure 3. An example central office 150 within the PSTN 110 is shown coupled to an optical network unit (ONU) 152. The fiber is terminated on a high speed switch 154 that comprises a plurality of 100BaseT ports. 100BaseS modems 156, 158 are shown coupled via 100BaseT connections to the high speed switch 154. The 100BaseS modem 156 is coupled to 100BaseS modem 162 within customer premises #1 160. The 100BaseS modem 162, in turn, is connected to the premises distribution network 164. The premises distribution network represents any 100BaseT capable network. Shown coupled to the premises distribution network are computer workstations 166, 168.

Paragraph beginning on page 15, line 15

The MII signal output from the 100Base Tx module 184 is input to a 2 port MII bridge 186. The bridge 186 functions to bidirectionally couple the MII signals from the module to [and from] a message memory unit 187 and an MII interface 188. The GT48006 2-Port 10/100 Mbps Ethernet Bridge/Switch Controller manufactured by Galileo Technology, San Jose, California may be used to implement the MII bridge 186. The message memory 187 functions to [soak up] absorb any differences in data rate between the two sides of the bridge.

Paragraph beginning on page 15, line 21

Date from the MII bridge 186 is input to the MII interface 188. The MII interface 188 is adapted to receive an MII data stream and output a decoded representation of the data that is stored in the flow and rate control memory 189. The function of the flow and rate control memory 189 is to [soak] absorb differences in transmitting rates between the 100BaseTX port and the 100BaseS port. The rate difference may be as high as 25 Mbps versus 100 Mbps depending on the number of pairs in use at the 100BaseT and 100BaseS ports. The controller is adapted to manage, administer and control the MII interface and the data splitter 190.

Equation (2) on page 17, line 8

$$\begin{aligned}\text{[upstream] } \underline{\text{downstream}} \text{ baud rate} &= \frac{28.125\,\text{Mbps}}{6\,\text{bits/symb}} \\ &= 4.6875\,\text{Msymbols/s}\end{aligned} \tag{2}$$

Paragraph beginning on page 17, line 20

A block diagram illustrating the transmit portion of the 100BaseS modem of the present invention in more detail is shown in Figure 6. Note that each DSL Ethernet Port [cards] card 196 (Figure 4) comprises an independent modem transmitter and receiver. [Therefore, the] The following description of the modem transmitter and receiver thus applies to each DSL Ethernet Port card. The data source feeding the modem supplies a transmit data signal and a transmit enable signal to the transmitter interface 80 of the 100BaseS modem. The transmit interface inputs digital data to the frame first in first out (FIFO) 82. The FIFO functions to adjust the rate of data flow between data source and the modem itself. The FIFO compensates for differences in the data rates between the two devices. The output of the FIFO is input to a sync generator 91, header generator 89 and the randomizer 84. The sync generator functions to generate and output two sync bytes to the frame formatter 89. Preferably, the two sync bytes are F6H and 28H. The header generator functions to generate header information that typically spans a plurality of bytes. The header itself is then

randomized or scrambled by randomizer 90 and subsequently encoded by encoder 92. The output of the [encode] encoder is input to the frame formatter 89.

Paragraph beginning on page 10, line 16

The transmitted power output by the system onto the twisted pair wire is preferably limited to 10 dBm (10 mW) in each direction. This power limit is widely incorporated into existing standards such as ANSI and ETSI. The transmit power is limited in order to [limit] better control the power spectral density (PSD) on the wire. The downstream power is thus fixed but the power transmitted on the upstream direction is controlled by the downstream link in accordance with the length of the wire so as to maintain the received power in the upstream direction at a constant level. Transmit power control is necessary in order to prevent excessive far end crosstalk to other upstream channels.

In the Abstract

A facility transport system for transporting high speed Ethernet data over digital subscriber lines. The system, referred to as 100BaseS, is capable of transmitting 100 Mbps Ethernet over existing copper infrastructure up to distances of approximately 400 meters. The system [of the present invention can achieve] achieves bit rates from 25 to 100 Mbps in increments of 25 Mbps with each 25 Mbps increment utilizing a separate copper wire pair. Each pair used provides a bidirectional 25 Mbps link with four copper wire pair connections providing 4 x 25 Mbps downstream channels and 4 x 25 Mbps upstream channels. The system utilizes framing circuitry to adapt the 100BaseT input data signal to up to four separate output signals. A DSL Ethernet Port card couples the modem to each twisted pair used. Each DSL Ethernet Port card comprises modem transmitter and receiver circuitry for sending and receiving 100BaseS signals onto [its respective] twisted pair wires. The system utilizes QAM in combination with frequency division multiplexing (FDM) to separate downstream channels from upstream channels and to separate both the downstream and the upstream channels from POTS and ISDN signals.

In the Claims:

1. (Amended) A point to point facility transport system for the symmetrical bidirectional transport of 100BaseTX Ethernet frame data over N copper wire pairs connecting a central office facility to a customer premise, comprising:

N downstream transmission paths for transporting a single 100BaseTX Ethernet [frame data transmitted] signal from the central office facility [destined] to the customer premise, each downstream transmission path operative to transport a 25 Mbps data stream;

N upstream transmission paths for transporting a single 100BaseTX Ethernet [frame data transmitted] signal from the customer premise [destined] to the central office facility, each upstream transmission path operative to transport a 25 Mbps data stream;

first modem means located at the central office facility and coupled to one end of said N downstream transmission paths and one end of said N upstream transmission paths;

second modem means located at the customer premises and coupled to the other end of said N downstream transmission paths and the other end of said N upstream transmission paths;

wherein said first modem means and said second modem means are operative to place onto and receive from said N copper wire pairs, data frames encapsulating said 100BaseTX Ethernet frame data; and

wherein N is a positive integer in the range of one to four.

4. (Amended) The facility transport system according to claim 1, wherein said first modem means and said second modem means further comprise:

a physical layer module for performing physical layer functions for 100BaseTX Ethernet[, said physical layer module operative to communicate over a Media Independent Interface (MII) bus];

a data splitter adapted to divide [the MII] a received 100BaseTX Ethernet data stream into N 25 Mbps output data streams, each output data stream destined for a transmitter;

N transmitters for coupling said N 25 Mbps output data streams to said N copper wire pairs, each transmitter adapted to modulate one of said 25 Mbps output data streams [output of said data splitter so as] to generate a transmit signal therefrom suitable for transmission onto one of said N copper wire pairs;

N receivers for coupling to said N copper wire pairs, each receiver adapted to demodulate a 25 Mbps signal received from one of said N copper sire pairs so as to generate a receive data signal therefrom; and

a data collector adapted to receive said N 25 Mbps receive data signals from said N receivers and to combine and reorganize said N 25 Mbps receive data signals into a single 100 Mbps data stream for output [via said physical layer module in a form] as a 100BaseTX compatible [with 100BaseTX] signal.

6. (Amended) A point to point facility transport system for the symmetrical bidirectional transport of 100BaseTX Ethernet frame data and plain old telephone service (POTS) over N copper wire pairs connecting a central office facility to a customer premise, comprising:

N downstream transmission paths for transporting a single 100BaseTX Ethernet [frame data] signal and POTS transmitted from the central office facility destined to the customer premise, each downstream transmission path operative to transport a 25 Mbps data stream;

N upstream transmission paths for transporting a single 100BaseTX Ethernet [frame data] signal and POTS transmitted from the customer premise destined to the central office facility, each upstream transmission path operative to transport a 25 Mbps data stream;

first modem means located at the central office facility and coupled to one end of said N downstream transmission paths and one end of said N upstream transmission paths;

second modem means located at the customer premises and coupled to the other end of said N downstream transmission paths and the other end of said N upstream transmission paths;

first splitter means coupled to said first modem means and to said [V] N copper wire pairs;

second splitter means coupled to said second modem means and to said N copper wire pairs;

wherein said first modem means and said second modem means are operative to place onto and receive from said N copper wire pairs data packets encapsulating [said] 100BaseTX Ethernet frame data;

wherein said first splitter means and said second splitter means are operative to combine and split said POTS and N downstream and N upstream transmission path signals; and

wherein N is a positive integer in the range of one to four.

9. (Amended) The facility transport system according to claim 6, wherein said first modem means and said second modem means further comprise:

a physical layer module for performing physical layer functions for 100BaseTX Ethernet, said physical layer module operative to communicate over a Media Independent Interface (MII) bus;

a data splitter adapted to divide the MII data stream into N output data streams, each output data stream destined for a transmitter;

N transmitters for coupling to said N copper wire pairs, each transmitter adapted to modulate one of said data streams output of said data splitter so as to generate a 25 Mbps transmit signal therefrom suitable for transmission onto one of said N copper wire pairs;

N receivers for coupling to said N copper wire pairs, each receiver adapted to demodulate a 25 Mbps signal received from one of said N copper sire pairs so as to generate a receive data signal therefrom; and

a data collector adapted to receive said N receive data signals from said N receivers and to combine and reorganize said N receive data signals into a single data stream for output via said physical layer module in a form compatible with 100BaseTX.

10. (Amended) A point to point facility transport system for the symmetrical bidirectional transport of 100BaseTX Ethernet frame data over N copper wire pairs connecting a central office facility to a customer premise, comprising:

N downstream transmission paths for transporting a single 100BaseTX Ethernet [frame data transmitted] signal from the central office facility [destined] to the customer premise, each downstream transmission path operative to transport a 25 Mbps data stream;

N upstream transmission paths for transporting a single 100BaseTX Ethernet [frame data transmitted] signal from the customer premise [destined] to the central office facility, each upstream transmission path operative to transport a 25 Mbps data stream;

switch means located at the central office facility and coupled to one end of said N downstream transmission paths and one end of said N upstream transmission paths;

a network element located at the customer premises and coupled to the other end of said N downstream transmission paths and the other end of said N upstream transmission paths; [and]

wherein said switch means and said network element are operative to place onto and receive from said N copper wire pairs data frames encapsulating [said] 100BaseTX Ethernet frame data[.]; and

wherein N is a positive integer in the range of one to four.

13. (Amended) The facility transport system according to claim 10, wherein said switch means and said network element further comprise:

a physical layer module for performing physical layer functions for 100BaseTX Ethernet[, said physical layer module operative to communicate over a Media Independent Interface (MII) bus];

a data splitter adapted to divide [the MII data] a received 100BaseTX Ethernet stream into N 25 Mbps output data streams, each output data stream destined for a transmitter;

N transmitters for coupling said N 25 Mbps output data streams to said N copper wire pairs, each transmitter adapted to modulate one of said 25 Mbps output data streams [output of said data splitter so as] to generate a transmit signal therefrom suitable for transmission onto one of said N copper wire pairs;

N receivers for coupling to said N copper wire pairs, each receiver adapted to demodulate a 25 Mbps signal received from one of said N copper sire pairs so as to generate a 25 Mbps receive data signal therefrom; and

a data collector adapted to receive said N 25 Mbps receive data signals from said N receivers and to combine and reorganize said N 25 Mbps receive data signals into a single 100 Mbps data stream for output [via said physical layer module in a form] as a 100BaseTX compatible [with 100BaseTX] signal.